



Jeff Sloan, U.S. Geological Survey



Jeff is the current UAS project manager in the USGS National Unmanned Aircraft Systems Project Office. He has worked for the U.S. government for more than 25 years for various agencies focusing on cartography. We recently had a chance to learn more about the USGS' latest work with UAS.

Since we last talked to the USGS, you have completed an elk population survey and documented dinosaur tracks. Can you tell us about these missions?

The USGS conducted two elk survey missions in April and May 2014, in Washington and California. The work in Washington was conducted in cooperation with Western Washington University and the work in California was conducted with the U.S. Fish and Wildlife Service, the California State Fish and Wildlife Service and the Bureau of Land Management. We really did not know if our UAS could be used for this type of work, given the current UAS platforms that we have and the resolution of the cameras that we have on board. Also, given the terrain and vegetation/tree cover, we assumed correctly that it would be difficult to randomly locate elk in large area expanses, given the current lower altitude limits that we are allowed to fly (below 400 ft) and in the type of terrain and tree cover that we were working.

We were not successful in locating the elk in Washington; however, we did find them in California, as they were in more open meadow areas with smaller vegetative cover. The fish and wildlife personnel were optimistic in its potential use, especially if the UAS could be guided to collared or radio-tagged animals. Then surveys of the accompanying herds could possibly be more effective. Nevertheless, the two different project locations did show us both the limits and the potential to use the technology for this type of work.



The use of UAS for dinosaur tracks was highly successful. This was a project the Bureau of Land Management and National Park Service had in place, with some additional USGS assistance, that took place in White Sands National Park near Las Cruces, New Mexico in January 2014. The BLM has been doing dinosaur track work using close range photogrammetric techniques for over more than 30 years in an attempt to record and model extremely accurate 3D measurements of the tracks that can be archived into a historical database.

In cases such as the tracks located in the White Sands National Park, they are uncovered – sometimes only for a brief period of time – as the sand is blown off to reveal the prints. The use of small UAS to quickly be deployed over known areas, or sometimes into unknown areas where prints

may exist, proved to be highly effective. UAS are able to control the image collection better than balloons, are more versatile, can collect images from a higher altitude and cover large areas faster than with a tripod camera. With the advent of the ‘computer vision’ modeling techniques, the photogrammetric software coupled with the overlapping stereo images collected from the small UAS make this a very effective system for collecting this type of close-range data.

Your background is in cartography. How are UAS useful in this field? What advantages do UAS offer over other surveying methods?

Modern cartography (mapmaking) primarily begins with the use of accurately scaled aerial photography. This has traditionally come from aerial photography collections from manned aircraft or from various satellites platforms. The traditional data collection, coupled with sophisticated photogrammetric techniques to reference and adjust the imagery to the correct geometry, is required to make a base aerial photo that can be used to create an accurate map.

There are now some very interesting techniques and advantages of using an UAS over these traditional methods. The small UAS in particular are safer to use at low altitudes and can maneuver better and more efficiently than manned aircraft. Satellite imagery collections are often dependent upon the orbit and resolution available with the on-board sensors, so timing and cloud cover become limiting factors for acquisition.

With small UAS, the cost of the platform and acquisition is considerably less, and will become even more cost-effective with advancement in flight planning, autonomy and reduced regulations. In addition, the rapid advancement in the technology of small, off-the-shelf cameras and sensors coupled with the even more rapid advancement in the computer vision (structures-from-motion) software technology makes the rectification of the imagery very feasible and highly affordable. The result is that even a small agency (e.g. wildlife refuge) or eventually a private land owner (e.g. farmer) will have the capability to collect and generate highly accurate base aerial photomaps or other data types using small, quickly deployable unmanned systems capable of producing data outputs that were not even possible less than five years ago. Obviously, that is why there is so much interest in this area of UAS use.



How did you get involved in working with UAS?

The USGS started investigating the use of UAS beginning in the 2000 to 2003 timeframe by observing the use of the systems by the military and when the U.S. Forest Service and NASA began using a modified Predator for use with Western U.S. wildfires. In 2009, the Army asked if we wanted some small AeroVironment Raven platforms that they were slated to be destroyed. We received those and began to investigate how they were to be handled by our UAS Office, the Department of the Interior Office of Aviation Services and the FAA. We are still trying to figure that all out, but have been making slow and steady progress since being trained and becoming operational in 2011. The demand for the use of our systems has not ceased since.

What are the overall benefits of using UAS in your work?

The greatest benefit of using the UAS for our work is the flexibility in owning and operating our own aerial collection systems. The flexibility comes from the rapid deployment, the maneuverability and safety involved in the low-altitude flying in difficult areas of terrain and environments. Also, the low overall costs of the systems, the speed and efficiency of the acquisition, and the increased level of data that is gained are all appealing benefits of this technology.

What upcoming missions does USGS have planned using UAS?

Inside the USGS National Project Office, we put a very high emphasis on any project in Hawaii – just kidding – of which there are a few in the works for vegetation studies and shoreline mapping investigations. With our limited resources and logistics, we try to space the work out to one or two projects a month. We will continue to support all of the Department of the Interior’s bureaus and, specifically in the next year, the Office of Surface Mining West Virginia coal mine inspections, the Bureau of Indian Affairs project in the Klamath River area of Oregon, USGS vegetation studies in the Topock Marsh area near the California/Arizona border and many wildlife surveys and other new creative projects that are still in the planning stages.

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